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Salter et al.

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- (54) **VEHICLE WINDOW EDGE WATER MANAGEMENT**
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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 208 days.

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B60J 5/04 (2006.01)
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CPC **B60J 10/25** (2016.02); **B60J 5/0418** (2013.01)

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- (58) **Field of Classification Search**
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USPC 296/154
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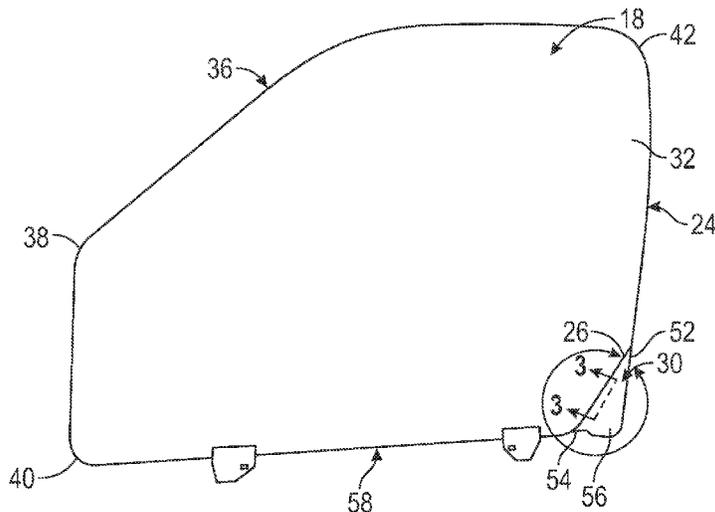
(57) **ABSTRACT**

Vehicle windows may include water management features. In some embodiments, the vehicle windows include a water management corner piece for managing the flow of water or other precipitation around the window. The water management corner piece may be secured to a window glass pane and may positioned and shaped for channeling the water along an engineered drainage path.

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20 Claims, 4 Drawing Sheets



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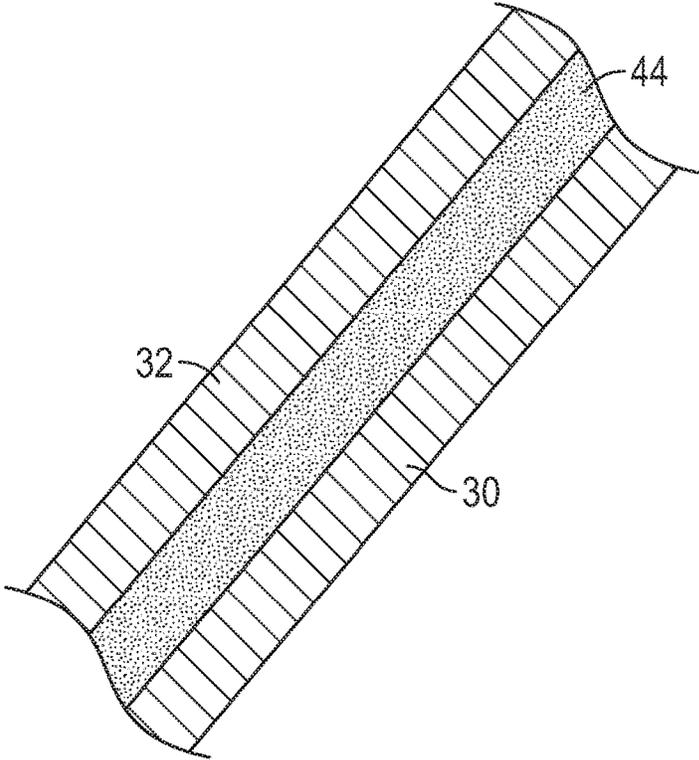


FIG. 3

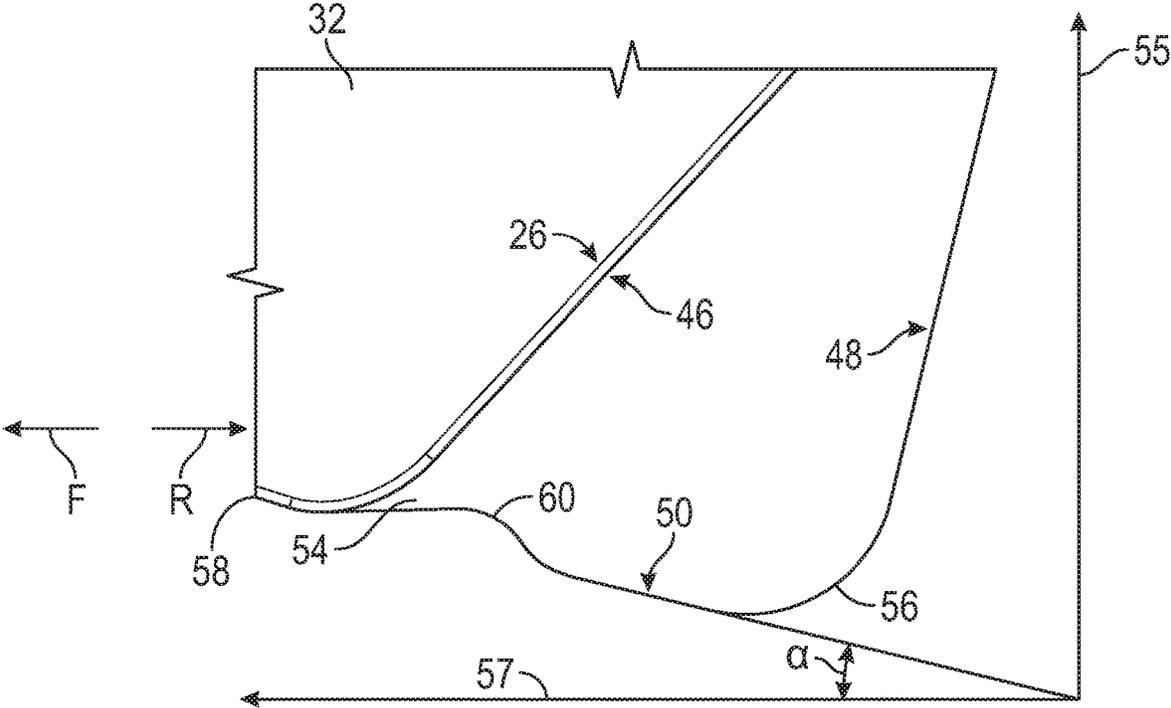


FIG. 4

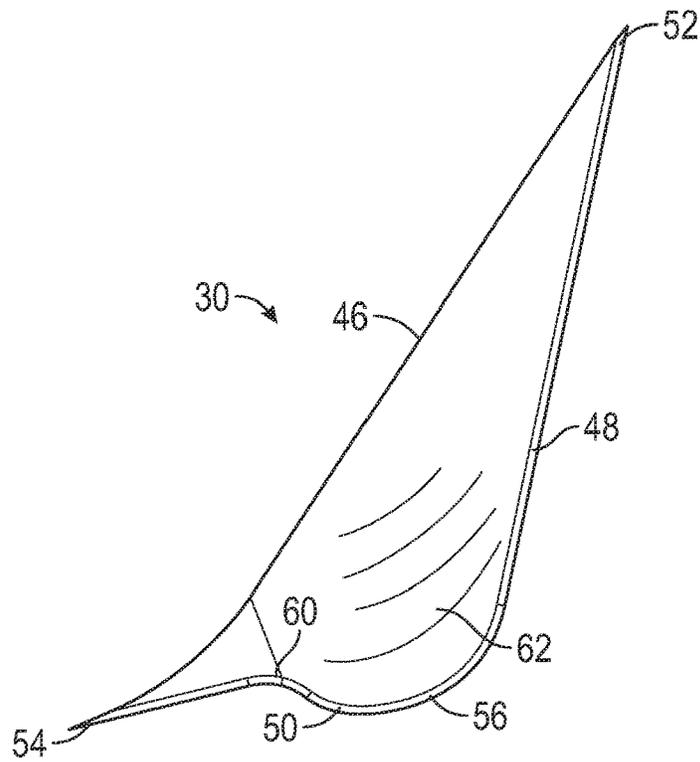


FIG. 5A

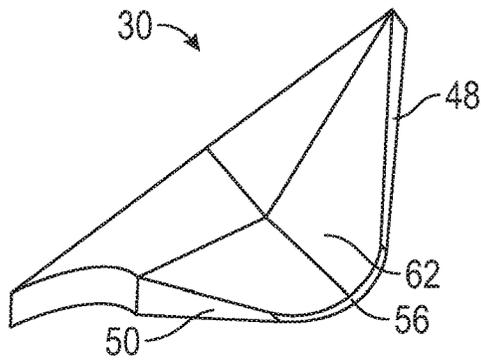


FIG. 5B

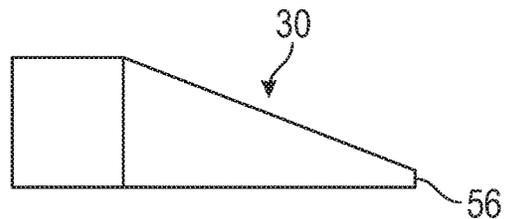


FIG. 5C

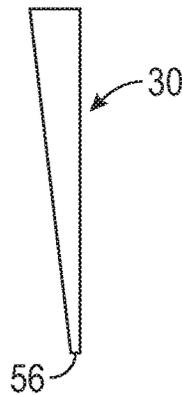


FIG. 5D

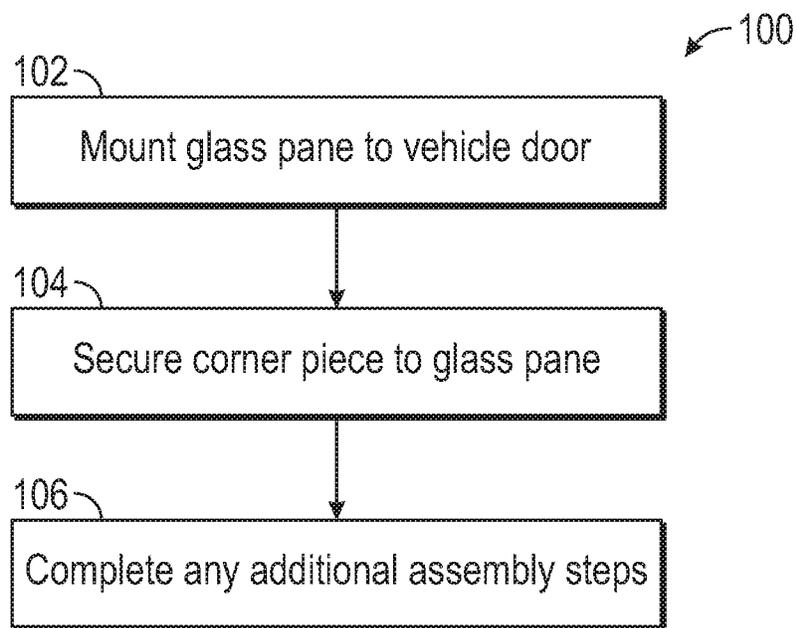


FIG. 6

VEHICLE WINDOW EDGE WATER MANAGEMENT

TECHNICAL FIELD

This disclosure relates to vehicle windows, and more particularly to vehicle window water management corner pieces that are positioned and shaped for managing the flow of water around the windows.

BACKGROUND

During rainfall or other precipitation generating events, water can matriculate around vehicle windows and drip inside the vehicle doors. It would be desirable to redirect any water flow to minimize this condition.

SUMMARY

A vehicle window according to an exemplary aspect of the present disclosure includes, among other things, a glass pane and a corner piece attached to the glass pane and configured to direct water along an engineered drainage path.

In a further non-limiting embodiment of the foregoing vehicle window, the corner piece is made of a hydrophilic material.

In a further non-limiting embodiment of either of the foregoing vehicle windows, the corner piece is coated with a hydrophilic coating.

In a further non-limiting embodiment of any of the foregoing vehicle windows, the corner piece is attached to an angled lower rear edge of the glass pane.

In a further non-limiting embodiment of any of the foregoing vehicle windows, the corner piece includes a body that includes a front edge, a rear edge, and a bottom edge.

In a further non-limiting embodiment of any of the foregoing vehicle windows, the bottom edge is positioned at an inclined angle relative to a horizontal axis of a vehicle containing the vehicle window.

In a further non-limiting embodiment of any of the foregoing vehicle windows, the inclined angle of the bottom edge is between 10 degrees and 20 degrees.

In a further non-limiting embodiment of any of the foregoing vehicle windows, a curved surface connects between the rear edge and the bottom edge.

In a further non-limiting embodiment of any of the foregoing vehicle windows, an inward radius feature is formed in the bottom edge.

In a further non-limiting embodiment of any of the foregoing vehicle windows, an adhesive secures the corner piece to the glass pane.

A vehicle according to another exemplary aspect of the present disclosure includes, among other things, a door and a window movably mounted within the door. The window includes a glass pane and a corner piece mounted to the glass pane. The corner piece is a separate component from the glass pane.

In a further non-limiting embodiment of the foregoing vehicle, the corner piece is made of a hydrophilic material or is coated with a hydrophilic coating.

In a further non-limiting embodiment of either of the foregoing vehicles, the corner piece includes a body that includes a front edge, a rear edge, and a bottom edge. The front edge and the rear edge meet together at an upper corner of the corner piece, the front edge and the bottom edge meet

together at a lower front corner of the corner piece, and the rear edge and the bottom edge meet together at a lower rear corner of the corner piece.

In a further non-limiting embodiment of any of the foregoing vehicles, the lower front corner of the corner piece is mounted to an angled lower rear edge of the glass pane.

In a further non-limiting embodiment of any of the foregoing vehicles, the bottom edge is positioned at an inclined angle relative to a horizontal axis of the vehicle when viewed in a direction extending from the lower rear corner toward the lower front corner of the corner piece.

In a further non-limiting embodiment of any of the foregoing vehicles, the inclined angle of the bottom edge is between 10 degrees and 20 degrees.

In a further non-limiting embodiment of any of the foregoing vehicles, a curved surface connects between the rear edge and the bottom edge.

In a further non-limiting embodiment of any of the foregoing vehicles, an adhesive is applied between the glass pane and the corner piece.

In a further non-limiting embodiment of any of the foregoing vehicles, the adhesive is a two-sided adhesive tape.

In a further non-limiting embodiment of any of the foregoing vehicles, the corner piece is mounted to the glass pane after securing the glass pane to the door.

The embodiments, examples, and alternatives of the preceding paragraphs, the claims, or the following description and drawings, including any of their various aspects or respective individual features, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

The various features and advantages of this disclosure will become apparent to those skilled in the art from the following detailed description. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a vehicle equipped with a door assembly that includes a door and a window.

FIG. 2 illustrates a window of a door assembly.

FIG. 3 is a cross-sectional view of a select portion of the window of FIG. 2.

FIG. 4 is a blown up view of a select portion of the window of FIG. 2.

FIGS. 5A, 5B, 5C, and 5D illustrate an exemplary water management corner piece for a vehicle window.

FIG. 6 schematically illustrates an exemplary vehicle assembly method.

DETAILED DESCRIPTION

This disclosure details vehicle windows that include water management features. In some embodiments, the vehicle windows include a water management corner piece for managing the flow of water or other precipitation around the window. The corner piece may be secured to a window glass pane and may be positioned and shaped for channeling the water along an engineered drainage path. These and other features of this disclosure are described in greater detail below.

FIG. 1 schematically illustrates select portions of a vehicle 10. The vehicle 10 could be a car, a truck, a van, a sport utility vehicle, or any other type of vehicle. In an

embodiment, the vehicle **10** is a conventional, internal combustion engine powered vehicle. In another embodiment, the vehicle **10** is a high voltage traction battery powered electric vehicle (e.g., battery electric vehicle (BEV), hybrid electric vehicle (HEV), plug-in hybrid electric vehicle (PHEV), etc.). In yet another embodiment, the vehicle **10** is an autonomous vehicle in which the motive functions of the vehicle **10** are controlled without direct input from a human driver.

Although a specific component relationship is illustrated in the figures of this disclosure, the illustrations are not intended to limit this disclosure. The placement and orientation of the various components of the vehicle **10** are shown schematically and could vary within the scope of this disclosure. In addition, the various figures accompanying this disclosure are not necessarily drawn to scale, and some features may be exaggerated or minimized to emphasize certain details of a particular component.

The vehicle **10** includes a vehicle body **12** that supports a door assembly **14**. The door assembly **14** may be utilized to enter and exit the vehicle **10**. Although a single door assembly **14** is shown in FIG. **1**, the vehicle **10** could include two or more door assemblies.

Each door assembly **14** of the vehicle **10** may include a door **16** and a window **18** movably mounted within the door **16**. The window **18** of FIG. **1** is illustrated in a closed position relative to the door **16**. The window **18** may be lowered into an open position relative to the door **16** in order to allow airflow to enter into the interior of the vehicle **10**. In the open position, the window **18** may be at least partially received within an interior cavity **20** of the door **16**. Various electronics **22**, such as keyhole mechanisms, latching mechanisms, window actuating mechanisms, etc., may also be housed in the interior cavity **20**. Portions of an exterior panel of the door **16** are removed in FIG. **1** to better illustrate the interior cavity **20**.

During rainfall or other precipitation generating events (e.g., car washes, etc.), water can matriculate along a rear edge **24** of the window **18** until it reaches an angled lower rear edge **26** that faces toward a rear of the vehicle **10**, at which point the water will typically drip off the window **18** and then down into the interior cavity **20** of the door **16**. The drainage path of the water is schematically illustrated in FIG. **1** by arrows **28**. Over time, the water that enters the interior cavity **20** can infiltrate the electronics **22** or render them temporarily inoperable (e.g., such as due to freezing during winter climate conditions). Water management corner pieces **30** (shown in phantom in FIG. **1**) that are designed to provide an engineered flow path for guiding the flow of water around the vehicle windows are therefore proposed within this disclosure.

FIG. **2** illustrates a window **18** of the vehicle **10** of FIG. **1**. The window **18** includes a glass pane **32** and a corner piece **30** attached to the glass pane **32**. As discussed in greater detail below, the corner piece **30** is designed to direct water along an engineered drainage path (shown schematically in FIG. **1** by arrows **34**) that substantially limits the amount of water entering into the interior cavity **20** of the door **16**, thereby increasing the functionality and lifespan of the electronics **22** that are housed inside the door **16**.

The glass pane **32** may include any size and shape within the scope of this disclosure. In an embodiment, the glass pane **32** includes an outer perimeter **36** that establishes an upper front edge **38**, a lower front edge **40**, an upper rear edge **42**, and an angled lower rear edge **26**.

The corner piece **30** is a separate structure that is attachable to the glass pane **32** of the window **18**. In an embodi-

ment, the corner piece **30** is attached to the angled lower rear edge **26** of the glass pane **32**. However, the corner piece **30** could be mounted at any location of the glass pane **32** where it is desirable to force water along an engineered drainage path.

The corner piece **30** may be secured to the glass pane **32** by an adhesive **44** (see FIG. **3**). In an embodiment, the adhesive **44** is a two-sided adhesive tape. However, other adhesives could alternatively be used to mount the corner piece **30** to the glass pane **32**.

In an embodiment, the corner piece **30** is made (e.g., molded or machined) from a hydrophilic material. Hydrophilic materials include surfaces in which the contact angle of a water droplet is 90 degrees or less and therefore the water tends to cling to the surface of the material. Providing the hydrophilic material will help ensure that the water is directed along the engineered drainage path once it comes into contact with the corner piece **30**. In an embodiment, the hydrophilic material is an acrylic, such as Poly(methyl methacrylate) (PMMA). However, other hydrophilic materials are also contemplated within the scope of this disclosure.

In an embodiment, the contact angle of the surface of the hydrophilic material may be enhanced, or made more hydrophilic, by surface treating the corner piece **30**. The corner piece **30** may be surface treated using an air plasma corona treatment, for example.

In another embodiment, the contact angle of the surface of the hydrophilic material of the corner piece **30** may be made more hydrophilic by coating the surface with a hydrophilic coating. An exemplary hydrophilic coating is the Aculon® AcuWet 470 hydrophilic coating, although other coatings may also be suitable.

Referring now primarily to FIGS. **2** and **4**, the corner piece **30** may include a body having a front edge **46**, a rear edge **48**, and a bottom edge **50**. When mounted, the front edge **46** faces toward a front section F of the vehicle **10** and the rear edge **48** faces toward a rear section R of the vehicle **10**. In addition, in a mounted position of the corner piece **30**, each of the front edge **46**, the rear edge **48**, and the bottom edge **50** extend at a transverse angle relative to both a Z-axis **55** (i.e., a vertical axis) and an X-axis **57** (i.e., a horizontal axis) of the vehicle **10**.

The front edge **46** and the rear edge **48** may meet together at an upper corner **52** of the corner piece **30**. The front edge **46** and the bottom edge **50** may meet together at a lower front corner **54** of the corner piece **30**. The rear edge **48** and the bottom edge **50** may meet together at a lower rear corner **56** of the corner piece **30**.

Referring primarily to FIG. **4**, the bottom edge **50** of the corner piece **30** may be angled at an inclined angle α relative to the X-axis **57** of the vehicle **10** and when viewed in a direction toward a lower edge **58** of the glass pane **32** (i.e., in a direction from the rear edge **48** toward the front edge **46** of the corner piece **30**). In an embodiment, the inclined angle α is between about 10 degrees and about 20 degrees. The inclined angle α helps ensure that water is drained from the window **18** at the lower rear corner **56** of the corner piece **30** rather than matriculating back toward the lower edge **58** of the glass pane **32**.

The bottom edge **50** of the corner piece **30** may additionally include an inward radius feature **60** (e.g., an indentation or bump formed in the bottom edge) that further exaggerates the inclined path of the bottom edge **50**. The inward radius feature **60** helps ensure that no water will escape the engineered drainage path established by the corner piece **30**. In an embodiment, the inward radius feature **60** is formed in

the bottom edge 50 at a location that is between the lower front corner 54 and the lower rear corner 56 of the corner piece 30.

FIGS. 5A-5D illustrate additional features of the corner piece 30 of the window 18. The corner piece 30 may include a curved surface 62 (best illustrated in FIGS. 5A and 5B) that connects the rear edge 48 to the bottom edge 50. The actual radius of the curved surface 62 may vary and is design dependent. The combination of the inclined angle α of the bottom edge 50 and the curved surface 62 establishes a funnel-like shape at the lower rear corner 56, thereby helping to guide water to drain at the lower rear corner 56 of the corner piece 30.

FIG. 6, with continued reference to FIGS. 1-5D, schematically illustrates a vehicle assembly method 100. In an embodiment, the vehicle assembly method 100 can be employed for mounting the window 18 to the door 16 of the vehicle 10.

First, at block 102, the glass pane 32 is mounted to the door 16 of the vehicle 10. The glass pane 32 may be movably secured relative to the door in any manner. Next, at block 104, the corner piece 30 is secured to the glass pane 32 using the adhesive 44. Additional assembly steps may be performed at block 106, such as additional assembly procedures along a vehicle assembly line, to complete the vehicle assembly method 100.

The corner piece 30 could also be utilized as an aftermarket part that may be attached to pre-existing car models where the glass pane is already mounted to the door. The corner piece may be designed to fit any window corner edge shape, thus making it useful for nearly any vehicle.

The window water management corner pieces of this disclosure are specifically positioned and shaped to force water to follow an engineered drainage path that is specifically created to direct water away from interior door electronics such as latching and keyhole mechanisms. The corner pieces thereby increase the functionality and lifespan of the electronics by ensuring that water does not enter the electronics and subsequently freeze. The ability to add the corner pieces onto windows after assembly allows current window designs to be used without modification.

Although the different non-limiting embodiments are illustrated as having specific components or steps, the embodiments of this disclosure are not limited to those particular combinations. It is possible to use some of the components or features from any of the non-limiting embodiments in combination with features or components from any of the other non-limiting embodiments.

It should be understood that like reference numerals identify corresponding or similar elements throughout the several drawings. It should be understood that although a particular component arrangement is disclosed and illustrated in these exemplary embodiments, other arrangements could also benefit from the teachings of this disclosure.

The foregoing description shall be interpreted as illustrative and not in any limiting sense. A worker of ordinary skill in the art would understand that certain modifications could come within the scope of this disclosure. For these reasons, the following claims should be studied to determine the true scope and content of this disclosure.

What is claimed is:

1. A vehicle window, comprising:

a glass pane; and

a corner piece attached to the glass pane and configured to direct water along an engineered drainage path, wherein the corner piece is attached to an angled lower rear edge of the glass pane.

2. The vehicle window as recited in claim 1, wherein the corner piece is made of a hydrophilic material.

3. The vehicle window as recited in claim 2, wherein the hydrophilic material is an acrylic material.

4. The vehicle window as recited in claim 3, wherein the acrylic material is Poly(methyl methacrylate) (PMMA).

5. The vehicle window as recited in claim 1, wherein the corner piece includes a body that includes a front edge, a rear edge, and a bottom edge.

6. The vehicle window as recited in claim 5, comprising a curved surface connecting between the rear edge and the bottom edge.

7. The vehicle window as recited in claim 5, comprising an inward radius feature formed in the bottom edge.

8. The vehicle window as recited in claim 7, wherein the inward radius feature includes an indentation or bump formed into the bottom edge, and further wherein the indentation or the bump is adapted to establish an inclined path of the bottom edge.

9. The vehicle window as recited in claim 1, comprising an adhesive that secures the corner piece to the glass pane.

10. A vehicle window, comprising:

a glass pane; and

a corner piece attached to the glass pane and configured to direct water along an engineered drainage path, wherein the corner piece includes a body that includes a front edge, a rear edge, and a bottom edge, wherein the bottom edge is positioned at an inclined angle relative to a horizontal axis of a vehicle containing the vehicle window.

11. The vehicle window as recited in claim 10, wherein the inclined angle is between 10 degrees and 20 degrees.

12. A vehicle, comprising:

a door;

a window mounted within the door and being movable between a closed position and an open position, wherein the window is at least partially received within an interior cavity of the door when in the open position; and

the window including a glass pane and a corner piece mounted to the glass pane, wherein the corner piece is a separate component from the glass pane and is configured to direct water along an engineered drainage path that guides the water away from interior door electronics housed within the interior cavity.

13. The vehicle as recited in claim 12, wherein the corner piece is made of a hydrophilic material or is coated with a hydrophilic coating.

14. The vehicle as recited in claim 12, wherein the corner piece includes a body that includes a front edge, a rear edge, and a bottom edge, wherein the front edge and the rear edge meet together at an upper corner of the corner piece, the front edge and the bottom edge meet together at a lower front corner of the corner piece, and the rear edge and the bottom edge meet together at a lower rear corner of the corner piece.

15. The vehicle as recited in claim 14, wherein the lower front corner of the corner piece is mounted to an angled lower rear edge of the glass pane.

16. The vehicle as recited in claim 14, wherein the bottom edge is positioned at an inclined angle relative to a horizontal axis of the vehicle when viewed in a direction extending from the lower rear corner toward the lower front corner of the corner piece.

17. The vehicle as recited in claim 16, wherein the inclined angle is between 10 degrees and 20 degrees.

18. The vehicle as recited in claim 14, comprising a curved surface connecting between the rear edge and the bottom edge.

19. The vehicle as recited in claim 12, comprising an adhesive applied between the glass pane and the corner piece, wherein the adhesive is a two-sided adhesive tape. 5

20. The vehicle window as recited in claim 1, wherein the corner piece is coated with a hydrophilic coating.

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